DRAFT
Willapa River
Fecal Coliform Bacteria
Total Maximum Daily Load

Water Quality Improvement Report

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Definitions

This report uses the following terms and definitions:

Clean Water Act (CWA): Formerly known as the Federal Water Pollution Control Act, the Clean Water Act contains a number of provisions to restore and maintain the quality of the nation's waters. Section 303(d), one of the provisions of the CWA, establishes the TMDL program.

Concentration: The amount or mass of a substance or material in a given volume or mass of sample. Concentrations of fecal coliform bacteria are usually measured in colony forming units per 100 milliliters of water (cfu/100mL).

Fecal Coliform (FC): Fecal coliform is bacteria present in the intestinal tracts and feces of warm-blooded animals. FC is used as an indicator organism to indicate the possible presence of disease-carrying (pathogenic) organisms. Fecal coliform lives in the same environment as pathogen, and increases in FC concentrations in water indicates increased likelihood of pathogen presence.

Geometric Mean: Either the 'n'th root of a product of 'n' factors, or the antilogarithm of the arithmetic mean of the logarithms of the individual sample values. It is common to report the geometric mean for fecal coliform data.

Load Allocation (LA): The portion of a receiving waters loading capacity attributed to one of its existing or future nonpoint sources of pollution or to natural background sources.

Loading Capacity: The greatest amount of contaminant loading that a water body can receive and still meet water quality standards.

Margin of Safety (MOS): A required component of TMDLs that accounts for uncertainty about the relationship between the pollutant loads and the quality of the receiving water body.

National Pollutant Discharge Elimination System (NPDES): The national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements under the Clean Water Act.

Nonpoint Source: Generally, any unconfined and diffuse source of contamination, such as unpermitted stormwater or snowmelt runoff, or atmospheric pollution. Legally, any source of water pollution that does not meet the legal definition of "point source" in section 502(14) of the Clean Water Act.

90th percentile: An estimated portion of a sample population based on a statistical determination of distribution characteristics. The 90th percentile value is a statistically derived estimate of the division between 90 percent of samples, which should be less than the value, and 10 percent of samples, which are expected to exceed the value.

Pathogen: Disease causing agents, especially microorganisms such as bacteria, protozoa, and viruses are called pathogens.

Phase II Stormwater Permit: The second phase of stormwater regulation required under the federal Clean Water Act covering smaller municipal separate storm sewer systems (MS4s) and construction sites over one acre.

Point Source: Point sources of pollution are sources that discharge at a specific location from pipes, outfalls, and conveyance channels from either municipal wastewater treatment plants, municipal stormwater facilities, or industrial waste treatment facilities. Point sources can also include pollutant loads contributed by tributaries to the main receiving water stream or river.

Pollution: Contamination, or other alteration of the physical, chemical, or biological properties of any waters of the state; or discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state that is likely to create a nuisance or render such waters harmful, detrimental, or injurious to the public health, safety, and welfare; or to livestock, wild animals, birds, fish, or other aquatic life.

Statistical Rollback Method: The statistical rollback method is an approach to working up environmental data that predicts pollutant concentrations after pollutant controls have been implemented.

Stormwater: The water that runs off roads, pavement, and roofs during rainfall or snow melt. Storm water can also come from hard or saturated grass surfaces like lawns, pastures, playfields, and from gravel roads and parking lots.

Total Maximum Daily Load (TMDL): The amount of a particular pollutant that a stream, lake, estuary, or other waterbody can handle without violating state water quality standards. TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measures that relate to a state's water quality standard.

Wasteload Allocation (WLA): The portion of a receiving water's loading capacity allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality-based effluent limitation.

Watershed: A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.

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- Mike Johnson of the Pacific Conservation District (CD) and Tom Salzer of the Washington Conservation Commission facilitated very positive discussions with the CD Board members and provided much of the report information about local agricultural pollution management programs and success. The CD Board should be especially commended for reaffirming in this TMDL their commitment to helping more landowners succeed with water quality and farm improvement practices.
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- Roberta Woods provided "plain-talk" suggestions and Kelly Bassett provided formatting support for the report.
- Gregory Zentner provided thoughtful and expert technical perspective to the project manager, USEPA and their contractor on the technical analysis; completed statistical analyses of other recent Willapa river data from several sources and created figures for this report that present a graphical view of current water quality conditions.
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Overview

This *Water Quality Improvement Report* describes the status of an ongoing bacteria pollution study in the Willapa River watershed. It explains the nature of pollution sources, how cleanup goals were determined based on 1998 sampling for baseline conditions, reviews more current water quality data to evaluate progress being made towards the cleanup goals, and recommends where more actions are needed to meet expected uses of the river and estuary. A cleanup plan outline is included that describes how ongoing water quality monitoring and resources can be focused towards cleanup of the most pressing problem areas. Local water protection work since 1998 has been very effective in lowering bacteria levels, yet more work is needed in certain areas of the watershed in order that water quality can consistently meet important local needs.

This report helps meet a required part of the Federal Clean Water Act (CWA).
It addresses fourteen locations in the Willapa watershed that are named on the CWA '303-d list' for bacteria reduction. Fecal coliform bacteria concentrations in these places during 1998 were high enough to indicate a potential health risk to recreational users. Various swimming holes in the river are used in the summertime by children and families. Several rope swings, and fishing lures dangling from tree branches along the river mark favorite recreation spots. There is one commercial retreat center and a private group campground on the upper river shoreline.
The tributaries and the mainstem Willapa River drain to an estuary and Willapa Bay. In the estuary inside a shoal at the river mouth is a traditional swimming hole of the Shoalwater Bay Indian Tribe. The bay supports Tribal, commercial, and private shellfish harvest. Elevated bacteria concentrations indicate a potential health risk to people who eat shellfish, and can result in restrictions on shellfish harvest. Fortunately there haven't been any harvest restrictions needed in the area of the Willapa River mouth for many years. However, the state marine water quality standard for shellfish protection is occasionally exceeded at Johnson Slough near the river mouth about one sample event each year.

The federal Clean Water Act requires that impaired water bodies be restored to clean water standards through a total maximum daily load, or TMDL, process. This process starts with a study and analysis of pollution levels and sources. Then, based on that analysis, it requires actions necessary to restore healthy water quality.
The first part of this report addresses the technical analysis and numeric cleanup goals determined from the 1998 sampling data. Data gathered after 1998 are not included in the TMDL analysis and calculation of cleanup goals, but are summarized in this report to review how much cleanup progress has occurred since 1998.
Post-1998 information are introduced as a transition to the second part of this document (the Improvement Report sections) which describes the framework and local process underway and planned for water quality restoration.

This report is based on seven years of data from the Department of Ecology, the Department of Health Shellfish Protection Program, and Pacific County. The report:

- Provides a comprehensive evaluation of data.
- Using data from the 1998 worst-case conditions analysis, calculates how much bacteria the creeks and river can tolerate and still be healthy for beneficial uses (called the 'loading capacity'), and how much reduction is needed to reach healthy levels.
- Proposes a monitoring strategy to evaluate the effectiveness of improvement measures.
- Describes the framework for water quality improvement, including participating organizations, primary funding sources, and the general approach to address primary pollution sources.

Water quality sampling by Ecology during 1998 generated data for the TMDL technical study that was completed by a contractor to EPA Region 10, Tetra Tech, Inc. (USEPA, 2004 a, 2004b). Bacteria reductions were calculated according to rigorous protocols and are provided for sampling locations that didn't meet standards. A “critical period” evaluation also occurred, to address the time of year when bacteria concentrations are highest. Reductions are typically calculated for the most critical time period to cover worst-possible conditions year-round.
There wasn't a unique critical period identified for the collective locations in this project: bacteria levels violated standards at various times and at most sampling stations at different times of the year.

However, the sampling station at Johnson Slough at the river mouth was identified as the most critical location because it is closer to the shellfish areas where the marine water quality standard is the most protective of any location in the TMDL study. While violations only occurred there on about a 10% frequency (based on reviews of annual data sets)- they typically occurred during winter or higher precipitation conditions.

Cleanup goals were determined by Tetra Tech as a primary deliverable of their TMDL development contract (USEPA, 2004a, and 2004 b). Bacteria reductions of up to 90% are recommended for places along the mainstem and levels need to be reduced up to 70% at the tributary locations sampled, **compared to the 1998 baseline conditions**. Nonpoint sources of bacteria pollution in the cities stormwater need to be reduced by 90%.

More recently, additional monitoring data were evaluated by Ecology to get a more current picture of water quality conditions compared to the 1998-based TMDL bacteria reduction goals. Data generated by Pacific County Health Department, Ecology, and state Health indicate that water quality has improved since 1998 throughout most of the watershed. They indicate that local restoration efforts underway since 1998 have been effective in substantially lowering bacteria levels. However, a description of baseline conditions and a determination of load reductions (goals) is required by the TMDL process in order to measure progress towards water cleanup and show that the TMDL has been achieved.
The percent-reduction goals determined from the 1998 data reductions are just that...goals. The final standard for achievement of the TMDL is for the river to be in compliance with water quality standards.

Based on the reductions so far, this plan suggests that water quality standards for bacteria can be consistently met within the next five years, by 2012. In January 2006 Ecology started a one-year comprehensive sampling project at 26 locations to verify the most current conditions and help local organizations focus limited resources on fixing remaining priority areas. Ongoing sampling is essential for maintaining the water quality protection focus.

Technical Findings and Cleanup Goals

Introduction

Background

The Willapa River basin drainage headwaters are in timberland, flows into agricultural valleys, passes through the cities of Raymond and South Bend and drains into northeastern Willapa Bay, Washington. The mainstem occupies about 42 miles of shoreline. The basin drainage including tributaries accounts for about 168,000 acres (Washington Conservation Commission, 1999). The results of two studies were merged to complete the technical basis for determining the TMDL cleanup goals. The studies separately evaluated 1997-1998 **baseline** conditions for the fresh-water area upstream of Camp One Rd., and the tidally influenced lower basin. The studies were completed for the USEPA Region 10 by their contractor Tetra Tech (*Analytical Framework and Technical Analysis for the Upper Willapa River Fecal Coliform Bacteria TMDL*-2004, and the *Lower Willapa River Fecal Coliform Bacteria Total Maximum Daily Load Evaluation*-2004). Water quality information collected since 1998 are also presented below, for comparison to the baseline technical studies. The baseline reports provide an appropriate reference point from which cleanup progress is being measured.

Ecology has listed the lower Willapa River under section 303(d) of the federal Clean Water Act as not meeting water quality standards for fecal coliform (FC) bacteria because of inadequate pollution controls.

Section 303(d) requires the states and U. S. Environmental Protection Agency (EPA) to establish "Total Maximum Daily Loads" (TMDLs) for all waterbodies on the Section 303(d) list. EPA must approve all TMDLs established by the State of Washington. A complete TMDL includes the following:

- Description of applicable water quality standards and relevant sources of pollutants;
- Technical analysis to determine the pollutant capacity of the waterbody;
- Allocations of pollutant loading to various sources;
- Margin of safety to account for scientific uncertainty;
- Method to account for seasonal variation;

- Monitoring plan and implementation strategy;
- Public participation in the TMDL development process.

In 1997, the Southwest Regional Office section of the Department of Ecology (Ecology) Water Quality Program conducted a Watershed Needs Assessment that included the Willapa River watershed (Ecology, 1997). The Willapa River was identified as a high priority for a TMDL technical study of FC bacteria, temperature and dissolved oxygen problems. TMDL studies and cleanup plans were completed in 2005 for the temperature and dissolved oxygen impairments.
The analytical model utilized to predict dissolved oxygen loading capacity and cleanup goals is the same model that has been applied to complete this bacteria TMDL study.
The principal local contact for Ecology during this study was the North Pacific County Infrastructure Action Team (NPCIAT). The NPCIAT consists of the cities of Raymond and South Bend, Pacific County, the Port of Willapa Harbor, the Pacific Conservation District (CD), and many of the industries and resource groups. Since the effects of the bacteria pollution were determined to be nonpoint (not occurring from specific facility discharge outfalls) coordination has been primarily with the CD (agricultural sources), County Health Department (human sources), and the cities (stormwater). A separate technical review team involving Tetra Tech, an NPCIAT consultant (Cosmopolitan Engineering), and Ecology agree that the technical rigor and findings of the studies provide a suitable basis for proceeding with this TMDL improvement report. NPCIAT also agreed to move forward with cleanup plan development--including documentation of cleanup progress to date.

Other Willapa study documents pertinent to this report include the Quality Assurance Project Plan (QAPP) (Pickett, 1998), and Data Summary Report (Pickett, 2000). The QAPP presents a review of historical data and a detailed description of the study plan. The Data Summary Report presents the data produced by field monitoring surveys, a summary of the Quality Assurance and Quality Control (QA/QC) analysis of the data, and an analysis of compliance with state water quality standards.

Geographic Area and Study Methods

The Willapa River watershed, which includes the Willapa River and its tributaries, has a drainage area of about 262 square miles (680 km^2) and is located in Pacific County in southwestern Washington. The headwater elevations are approximately 6890 ft (2100 m). Major tributaries in the upper basin are: Falls Creek, Fern Creek, Fork Creek, Trap Creek, Stringer Creek, Mill Creek.

The lower Willapa River flows through the cities of Raymond and South Bend and empties into Willapa Bay. It is tidally influenced from its mouth at Willapa Bay to

approximately Camp One Road (a distance of about 14.5 miles). Major tributaries to lower Willapa River include South Fork Willapa River, Wilson Creek, and Ellis Creek. South Fork Willapa River joins the Willapa River at about river mile (RM) 7.1 and Wilson Creek enters the Willapa River at RM 12.1. From the confluence with Mill Creek (RM 17.9) to its headwaters, the gradient of the Willapa River changes from moderate to steep which damps out the tidal influence. Maps of the study area are presented in Figures 1 and 2. Figure 1 is based on a map from the Tetra Tech report (USEPA, 2004a) for the lower river TMDL analysis. That analysis focused on seven 303-d listed locations from the most upstream point near Camp One Rd. to the river mouth at Johnson Slough.

Figure 2 is excerpted from the Tetra Tech report (USEPA, 2004b) for the upper river analysis to show sample locations for that study. Seven of the upper river sample locations have been identified as 303-d listed river segments for which the analysis has calculated bacteria reduction goals.

All 303-d listed locations which have bacteria reduction goals determined are named in Tables 1, 2, and 3.

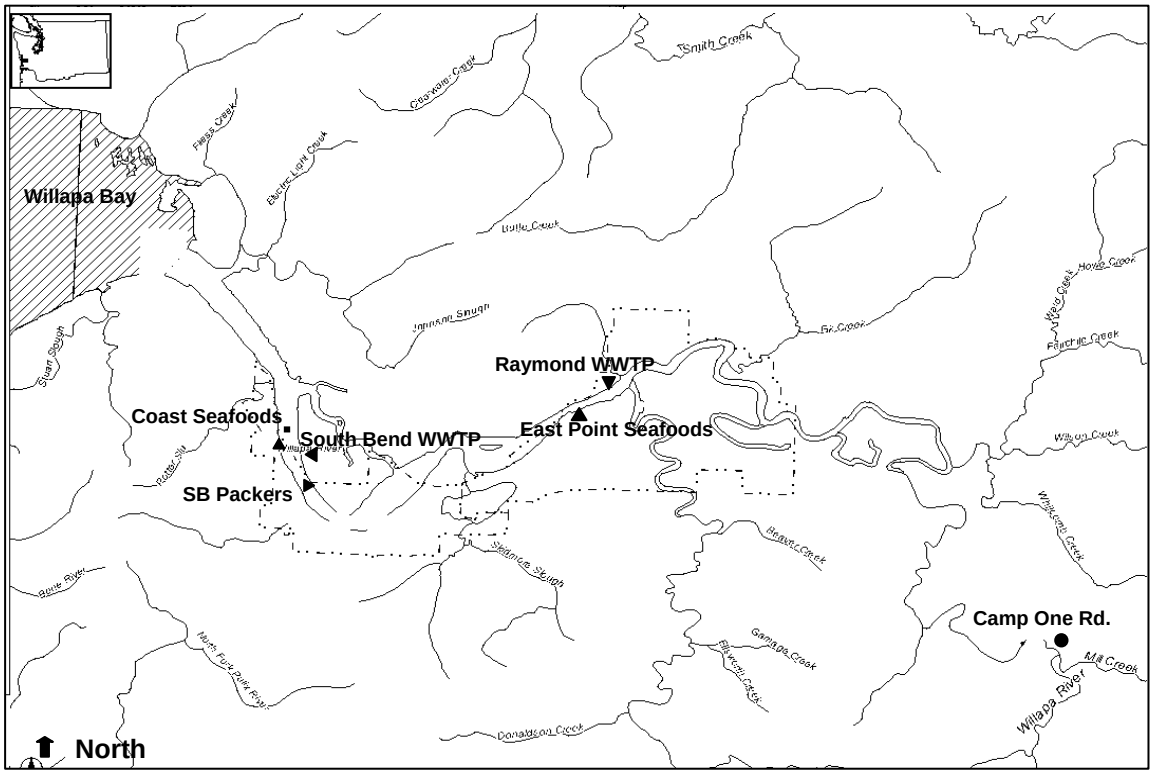


Figure 1. Lower Willapa River study area.

The principal land uses in the Willapa River watershed are forest (80%), agriculture (8%), and other (12%). The "other" land use category includes non-forest, developed land, open water, and wetlands. In the upper, steeper part of the watershed, the dominant

land use is commercial forest, managed by a mixture of private owners as well as state and federal agencies. Where the slope decreases, a relatively wide valley floor develops, and the primary land cover changes to agriculture with livestock farms and pasture. According to the 2000 U.S. Census, the population of Pacific County is 20,984. The two major urban centers in the Willapa River watershed are the cities of Raymond and South Bend, both located in the lower Willapa River.

About half way from the river mouth to the headwaters is a point known as the Camp One Rd. bridge. It is the upstream point where tidal influence ends, so was chosen as the point separating the upper and lower river technical studies. The channel below Camp One Road is relatively narrow and winding, passing through agricultural area. Near the town of old Willapa at RM 12.0, Wilson Creek enters the river and the river channel becomes much wider. Below Wilson Creek the river passes through an area of numerous sloughs and tidal wetlands. The Highway 101 bridge over the Willapa River marks the upstream end of the maintained navigation channel and the beginning of the Raymond urban area.

The South Fork Willapa River enters the Willapa at RM 7.1. Tidal effects extend up the South Fork about 4.5 miles through an area of tidal wetlands and sloughs. The South Fork watershed represents about 20% of the total watershed area. However, summer base flows in the South Fork are actually slightly higher than in the mainstem Willapa River above the South Fork.

The mouth of the South Fork is in the industrial area of Raymond. The Weyerhaeuser lumber mill lies on the north bank, a Pacific Hardwoods mill on Port lands on the south bank, the Port docks just downstream of the mouth, and the Raymond municipal wastewater treatment plant (WWTP) across the mainstem from the mouth. An Ecology marine ambient monitoring site WPA001 is just off the Port docks.

From the South Fork to the Bay, the Willapa River is relatively wide, except for an area called “The Narrows” between Raymond and South Bend. Just below the narrows is a small industrial area with a Pacific Hardwoods mill and East Point Seafoods. The two other fish processors in South Bend are South Bend Packers near the center of town and Coast Seafoods at the west end of town. The South Bend WWTP sits between the river and Mailboat Slough across from the city. The Mailboat slough area floods during high tides, which limits access to the South Bend WWTP. The mouth of the Willapa River is considered to be near the “Green 33” navigation aid and Johnson Slough.

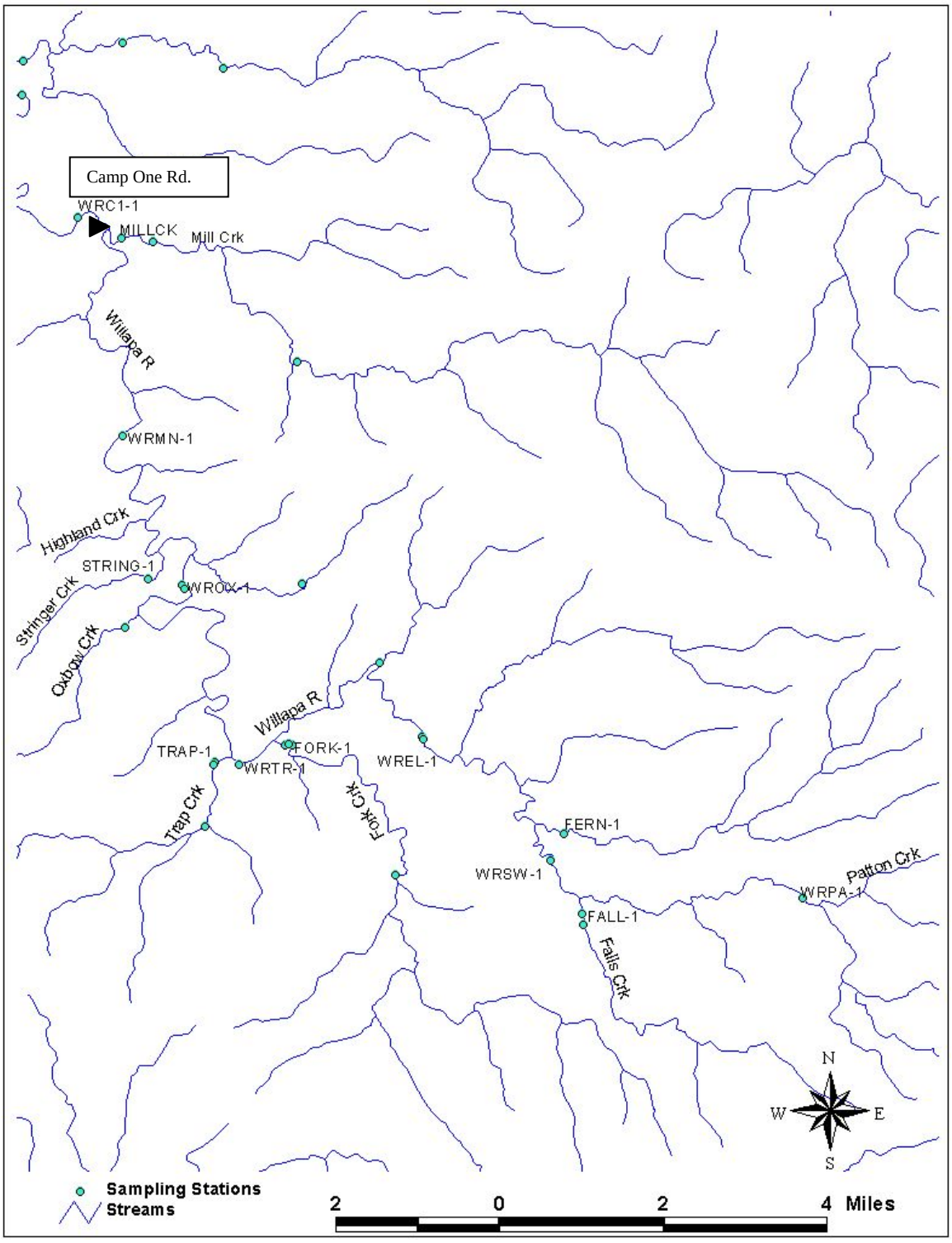


Figure 2. Sample locations in Upper Willapa River study area.

Flows in Willapa River have been monitored since 1947 (continuously since 1961) at USGS station 12013500 (Willapa River near Willapa, WA), which has a contributing

area of about 130 square miles. Mean monthly flow is highest in December (1,509 cfs) and lowest in August (48.7 cfs). The mean annual flow at the USGS station is 636 cfs.

A previous TMDL study of low dissolved oxygen conditions during late summer in the lower river generated a computer model that was also used for the bacteria study of this TMDL. The purpose of the computer modeling process was to calculate how much pollution is entering the river system overall and figure in the effect of other environmental factors to estimate how much pollution the river can receive without getting overloaded (when state water quality standards are violated). Environmental models are by nature pretty complex yet still imprecise. Most simply, they are a set of mathematical formulas explaining how multiple processes interact in a natural system. For instance, the fate and movement of fecal coliform bacteria in the environment is driven by rainfall, climate, light intensity, salinity and quantity of the receiving water, and many other factors. Numeric values for the many environmental factors that affect the fecal coliform bacteria buildup (dilution, transport, life-span, etc), are entered into the model. The model is built to capture the primary interrelationships of the real-world system. It's a tool for simulating the behavior of a pollutant under certain "programmed" conditions.

It's not practical or cost-effective to conduct field experiments to recreate the multitude of environmental processes affecting discharge and buildup of bacteria pollution in the Willapa River system year-round. So, the model serves as a computer program tool to experiment with, or simulate multiple scenarios to find ways to improve the environment. The computer model allows for a relatively quick and useful way to evaluate numerous options for limiting pollution quantities and effects, by comparing the causes and effects of many scenarios of bacteria loading. Numeric values that are commonly entered into the computer modeling analysis include factors such as: timing and rate of rainfall, river-flow rates, estimated rate of bacteria deposits from certain wildlife sources like birds, salt concentration in the water, and air and water temperature. Real data from water quality samples are a vital piece of the model too. Values from more than 675 fecal coliform bacteria samples were included in this Willapa TMDL analysis.

The modeling process is designed to eventually predict how much the pollution must be reduced under certain environmental factors, in order for each stretch of the river system to meet standards and to assure that each stretch of the river can fulfill whatever designated beneficial uses are expected from it. The technical analysis with its computer modeling steps are typically sophisticated and described in very complex technical terms. The technical explanation for the methods used in this TMDL project are described in the consultants reports referenced as Appendices A and B of this report.

Impaired Waterbodies and Relevant Water Quality Standards

The Surface Water Quality Standards (WQS) for the State of Washington are described in Chapter 173-201A WAC. The Willapa River and its tributaries in the study area are subject to Class A fresh water standards, with the exception of the downstream 1.8 miles of the study area, which is subject to Class A marine standards. According to the WQS regulations, the boundary between marine and freshwater standards occurs at Mailboat Slough navigation light (RM 1.8). Water Quality Standards for fecal coliform bacteria are as follows:

> Class A Freshwater: Fecal coliform organism levels shall not exceed a geometric mean value of 100 colonies/100 mL and not have more than 10 percent of all samples obtained for calculating the geometric mean value exceeding 200 colonies/100 mL.
>
> Class A Marine: Fecal coliform organism levels shall not exceed a geometric mean value of 14 colonies/100 mL and not have more than 10 percent of all samples obtained for calculating the geometric mean value exceeding 43 colonies/100 mL.

Water bodies that do not meet the water quality standards despite the presence of technology-based pollutant controls are required by Section 303(d) of the Clean Water Act to be placed on a list of water-quality limited water bodies.
Waterbodies in the lower Willapa River study area listed in 2004 for exceedance of the fecal coliform bacteria water quality standard and which are covered by this TMDL Improvement Report are shown in Table 1. Listings of upper river locations are covered in Tables 2 and 3.

If water quality standards are not being met or are threatened by existing pollutant sources, then a Total Daily Maximum Load (TMDL) may be established to regulate acceptable pollutant loads, as required under Section 303(d) of the Federal Clean Water Act. The combined effects of various sources in the basin need to be evaluated as part of the TMDL technical study, to determine the best strategy to establish a TMDL and protect beneficial uses for the basin. The TMDL may be apportioned between point sources (waste load allocations or WLAs) if present, and nonpoint or background sources

(load allocations or LAs). The allocations (WLAs and LAs) may be implemented through NPDES permits, state waste discharge permits, grant projects, watershed action plans, and other nonpoint source control activities.

Table 1. Waterbodies in Lower Willapa River on 2004 303(d) list for FC bacteria impairment.

Listing ID	Name	Township, Range, Section
10013	Willapa River @ Johnson Slough	14N, 09W, 24
6688	Willapa River near South Bend	14N, 09W, 21
9998	Willapa River near Port of Willapa	14N, 09W, 24
10000	Willapa River near Raymond	14N, 08W, 19
9989	Riverdale Creek @ Lions Park	14N, 09W, 24
10002	Willapa River near Willapa	13N, 08W, 52
10001	Willapa River downstream of Mill Creek	14N, 08W, 27

Table 2. Waterbodies in Upper Willapa River (mainstem) on 2004 303(d) list for FC Bacteria impairment.

Listing ID	Name	Township, Range, Section
10007	Willapa River @ Swiss Picknick Camp	12N, 07W, 03
10006	Willapa River @ Lebam	12N, 07W, 04
10004	Willapa River @ Oxbow Rd.	13N, 08W, 48
10003	Willapa River @SR6 near Menlo	13N, 08W, 14

Table 3. Tributaries to Upper Willapa River on 2004 303(d) list for FC Bacteria.

Listing ID	Name	Township, Range, Section
9984	Fern Creek @ Elk Prairie Rd.	12N, 07W, 03
9983	Falls Creek @ Retreat Center	12N, 07W, 11
10009	Wilson Creek near mouth	14N, 08W, 27

Pollution Sources

There are five permitted NPDES dischargers in the Lower Willapa River in the study area which have the potential to affect FC bacteria (Table 4). Two of the discharges are NPDES permitted municipal wastewater treatment plants (WWTPs) and the other three are seafood-processing facilities. The seafood processors screen their wastewater and discharge directly to the Willapa River. Coast Seafoods processes oysters and uses a mixture of saline river water for shell washing and city water for processing. East Point seafood processes a variety of products, including fish, crab and shrimp, and uses city water for processing. South Bend Packers mostly processes fish filets and sometimes processes oysters.

A number of potential nonpoint pollutant sources exist in the lower Willapa River study area. Urban stormwater reaches the Willapa River via overland runoff and direct stormwater discharges. Agricultural practices are a likely source of nonpoint pollutants that reach the Willapa River through overland flow to tributary streams, or direct contact from farm animals. Most of the farmland in the study area lies in the wide river valleys adjacent to the Willapa River and its tributaries. Tidal flooding of pasture in parts of the lower river and estuary may also transport livestock waste into the river. Failing or inadequate septic systems are another potential pollutant source. Wildlife and waterfowl also contribute fecal coliform (FC) bacteria in the study area.

Table 4. NPDES permitted facilities discharging to Lower Willapa River.

Facility Name	NPDES ID	Permit Flow (mgd)	Permit FC Bacteria (cfu/100 mL)	Max. FC reported 1998-2002 (cfu/100 mL)
Coast Seafood	WA0002186	0.099	*	1,600
City of South Bend WWTP	WA0037591	0.375	200	532
South Bend Packers	WA0040941	0.010	*	1,600
East Point Seafood	WA0001104	0.320	*	2,200
City of Raymond WWTP	WA0023329	1.500	200	502

* = Unrelated to this TMDL, permit limits will be set in the next permit-cycle for all seafood processors in the southwest Washington coatal areas. This will provide protection equivalent to what is required in neighboring city treatment plant discharge permits. These facilities are currently only required to monitor for bacteria.

A sensitivity analysis was performed on the computer model to test its usefulness as a tool for predicting which conditions most affect bacteria loading. The sensitivity analysis helped determine that:

- During the spring and summer months when tributary flows were low, FC bacteria levels in the vicinity of Mailboat Slough were sensitive to changes in loading from the cow pasture that adjoins the river at that location. The impact of the cow pasture FC bacteria loads was not as evident during the fall months (November and December) when tributary flows and loads were higher.
- Changing the loads of the Raymond WWTP and South Bend WWTP as well as the three seafood-processing plants had little impact on the FC bacteria levels in the lower Willapa River.
- Tributary flows and loads had the most significant impact on overall FC bacteria concentrations in the lower Willapa River.
- Little is known about the FC bacteria loading from wildlife and waterfowl. A constant nominal load of 2.5 billion colonies/day was added to each WASP model segment in the lower Willapa River downstream of Ellis Slough. This corresponded to approximately the daily bacteria load expected from one duck (EPA, 2001) to each model segment.

Overall, the model predicted the geometric mean and 90th percentile FC bacteria concentrations, and captured the timing and geographic distribution of maximum values. The model overpredicted FC bacteria for some times and locations and underpredicted FC bacteria at others, showing no substantial bias overall. If sources of variability are given due consideration, the model can be used to develop reasonable TMDL allocation scenarios.

Lower River TMDL Allocation Scenarios

Following calibration, the model was run for a period that included critical seasonal environmental conditions as well as estimated maximum pollutant loading levels from point sources and nonpoint sources. Since the model was calibrated using FC bacteria data from 1998, that year was also selected for use in the TMDL allocation scenario analysis. For the TMDL allocation simulations, the model was run for the period April 1 to December 24, 1998, which includes a spring-summer period (April 1 to October 31) characterized by low tributary flows and a fall period (November 1 to December 24) characterized by relatively high tributary flows.

The TMDL allocation scenarios developed in this report provide examples of possible TMDLs using the Willapa River water quality model (Table 5). The baseline condition and six allocation scenarios were simulated using the model. TMDL allocations were developed for the spring-summer period (April-October) and the fall period (November-

December). A description of how well the scenarios achieve water quality standards is provided in Table 6.

Allocations were made to five categories of FC bacteria sources: the wastewater treatment plants, the seafood processors, the upstream Willapa River boundary at Camp One Rd., other peripheral tributaries, and the cow pasture in the vicinity of Mailboat Slough. For the modeling baseline conditions, the Raymond and South Bend WWTPs as well as the seafood-processing plants were set to their permitted flow rates and the worse case FC concentration measured during the period 1998-2002 (see Table 5). Bacteria loads for the Willapa River upstream boundary and the other tributaries were calculated using the flows and FC concentrations from the 1998 calibration. The loading from the cow pasture was estimated based on the presence of between 2 and 50 cows at various times of the year. The FC bacteria load for one cow was estimated as 1.0E+11 cfu/day (EPA, 2004a).

The critical location for compliance with the water quality standard is the lower 1.8 miles of Willapa River, which is subject to the more stringent marine Class A standard. Allocation alternative 6 is necessary to satisfy both the geometric mean and 90th percentile standard year-round. Allocation alternative 5 *would* meet standards year-round, except that it fails the geometric mean criteria in the fall, in the marine waters downstream of RM 1.8.

Table 5. Lower River TMDL allocation scenarios

Alternative 0: Baseline Conditions	
WWTPs and Seafood Processors	At permitted flow and worst case FC concentration (1998-2002 data)
Upper Willapa River	Set at 1998 flow and FC concentrations
Other tributaries	Set at 1998 flow and FC concentrations
Cow pasture	Load determined from estimate of 5 to 50 cows in pasture
Municipal stormwater	Based on 1998 estimated rainfall.
Alternative 1	
WWTPs and Seafood Processors	No reduction from base condition
Upper Willapa River	FC set to geometric mean of 58.2 cfu/100mL (per upper Willapa TMDL)
Other tributaries	FC set to geometric mean of 100 cfu/100mL (water quality standard)
Cow pasture	No reduction from base condition
Municipal stormwater	No reduction from base condition.
Alternative 2	
WWTPs and Seafood Processors	Set to permitted flow rates; FC set to 200 cfu/100mL
Upper Willapa River	FC set to geometric mean of 58.2 cfu/100mL (per upper Willapa TMDL)
Other tributaries	FC set to geometric mean of 100 cfu/100mL (water quality standard)
Cow pasture	No reduction from base condition
Municipal stormwater	No reduction from base condition.
Alternative 3	
WWTPs and Seafood Processors	Set to permitted flow rates; FC set to 200 cfu/100mL
Upper Willapa River	FC set to geometric mean of 58.2 cfu/100mL (per upper Willapa TMDL)
Other tributaries	FC set to geometric mean of 100 cfu/100mL (water quality standard)
Cow pasture	Load reduced 90% from base condition.
Municipal stormwater	No reduction from base condition.

Alternative 4

WWTPs and Seafood Processors	Set to permitted flow rates; FC set to 200 cfu/100mL
Upper Willapa River	FC set to geometric mean of 58.2 cfu/100mL (per upper Willapa TMDL)
Other tributaries	FC set to geometric mean of 100 cfu/100mL (water quality standard)
Cow pasture	Load reduced 90% from base condition.
Municipal stormwater	Load reduced 90% from base condition.

Alternative 5

WWTPs and Seafood Processors	Set to permitted flow rates; FC set to 200 cfu/100mL
Upper Willapa River	FC set to geometric mean of 58.2 cfu/100mL (per upper Willapa TMDL)
Other tributaries	FC set to geometric mean of 25 cfu/100mL
Cow pasture	Load reduced 90% from base condition
Municipal stormwater	Load reduced 90% from base condition.

Alternative 6

WWTPs and Seafood Processors	Set to permitted flow rates; FC set to 200 cfu/100mL
Upper Willapa River	FC set to geometric mean of 25 cfu/100mL (per upper Willapa TMDL)
Other tributaries	FC set to geometric mean of 25 cfu/100mL
Cow pasture	Load reduced 90% from base condition
Municipal stormwater	Load reduced 90% from base condition.

Lower River TMDL Allocation Results

The TMDL fecal coliform targets for the lower river were calculated based on a concentration, and flow rates to assign fecal coliform count loads for each source. To meet the TMDL, concentration-based load allocations were established for all sources included in the Willapa River model. This allocation of fecal coliform loads addresses the criteria compliance requirements under various hydrologic conditions.
A summary indicating whether the freshwater and marine water quality standards were protected for a given scenario is shown in Table 6. The calculated fecal coliform loads for the baseline conditions and for allocation alternatives 3 and 6 are provided in Table 7. The TMDL allocations are shown for two seasonal time periods: Spring-Summer (April-October) and late Fall (November-December). These time periods excluding January through March cover the time when the highest observed bacteria concentrations exceeded the water quality standards.

Table 6. Lower River TMDL alternatives and protection of FC bacteria water quality standards.

TMDL Alternative	Is Geometric Mean WQS protected?				Is 90th Percentile WQS protected?			
	Apr-Oct		Nov-Dec		Apr-Oct		Nov-Dec	
	Freshwater	Marine	Freshwater	Marine	Freshwater	Marine	Freshwater	Marine
0	No	No	No	No	No	No	No	No
1	Yes	No	Yes	No	Yes	Yes	Yes	No
2	Yes	No	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	No	Yes	Yes	Yes	No
5	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 7. Seasonal allocation results for Lower Willapa River FC bacteria TMDL. **

Source	Spring-Summer (April-October)			Late Fall (November-December)		
	Baseline cfu	**TMDL Alt.3 cfu**	**Reduction**	**Baseline cfu**	**TMDL Alt. 6 cfu**	**Reduction**
Raymond WWTP	1.996E+11	7.950E+10	60.2%	8.552E+10	3.407E+10	60.2%
South Bend WWTP	5.287E+10	1.988E+10	62.4%	2.266E+10	8.518E+09	62.4%
Coast Seafoods	1.154E+12	5.247E+09	99.5%	4.947E+11	2.249E+09	99.5%
South Bend Packers	4.240E+09	5.299E+08	87.5%	1.817E+09	2.271E+08	87.5%
East Point Seafoods	1.895E+11	1.723E+10	90.9%	8.121E+10	7.382E+09	90.9%
Stormwater (South Bend)	3.405E+13	3.405E+13	0.0%	8.157E+13	8.157E+12	90.0%
Stormwater (Raymond)	1.037E+14	1.037E+14	0.0%	2.483E+14	2.483E+13	90.0%
Total WLA	**1.393E+14**	**1.378E+14**	**1.1%**	**3.306E+14**	**3.304E+13**	**90.0%**
Waterfowl and wildlife	6.010E+14	6.010E+14	0.0%	2.350E+14	2.350E+14	0.0%
Upper Willapa River	4.689E+13	3.832E+13	18.3%	4.469E+14	9.059E+13	79.7%
Other tributaries and pasture	3.489E+15	4.071E+14	88.3%	1.728E+15	1.900E+14	89.0%
Total LA	**4.137E+15**	**1.046E+15**	**74.7%**	**2.410E+15**	**5.156E+14**	**78.6%**
Total LA and WLA	**4.267E+15**	**1.184E+15**	**72.3%**	**2.740E+15**	**5.486E+14**	**80.0%**

**** Per Table 5, facilities operating within their current permits would already be meeting these reductions (i.e., "set to permitted flow rates"). Reductions were calculated from discharge monitoring reports when facilities weren't always meeting their limits. Current limits are set to achieve the above reductions. Actual**

TMDL reductions carried forward to the improvement report apply only to the nonpoint sources including stormwater.

Technical Analysis for the Upper River TMDL

Data for the upper Willapa River basin were collected at several locations and have been reported in *Willapa River Dissolved Oxygen and Fecal Coliform Bacteria Total Daily Load* (Pickett, 2000). Figure 2 shows the study area and the sampling locations. Sampling was conducted for one year (1998) at seven locations along the main stem from near the headwaters below Patton Creek to the Camp One Rd site near Bullard Road and at six tributary stations (Table 8).

Table 8. Fecal Coliform Sampling along the Upper Willapa River (1998)

Mainstem RM	Tributary RM	Sampling Station	Location on Figure 2 Map
41.2		Willapa R below Patton Creek	WRPA-1
37.5	0.3	Falls Ck above Retreat Center	FALLS
37.1		Willapa R at Swiss Picknik Rd	WRSW-1
36.2	0.4	Fern Creek at Elk Prairie Rd	FERN-1
33.2		Willapa R at Lebam	WRLE
30.5	0.25	Fork Creek at State Hatchery	FORK-1
30		Willapa R above Trap Creek	WRTR-1
29.9	0.15	Trap Creek above Hwy 6	TRAP-1
25.2		Willapa R at Oxbow Road	WROX-1
24.2	0.5	Stringer Ck at Highland-Stringer Rd	STRINGER
21.4		Willapa R at SR 6 near Menlo	WRMN-1
17.9	0.3	Mill Creek at 1st Mill Ck Rd Br	MILLCK
17.5		Willapa R at Camp One Rd	WRC1-1
16.2	0.8	Wilson Creek at 1st Wilson Ck Rd Br from Old Willapa	Not shown

The data were first analyzed in the *Willapa River Dissolved Oxygen and Fecal Coliform Bacteria Total Daily Load* study (Pickett, 2000) to determine compliance with water quality standards. The analysis showed that exceedances occurred at different times during the year (anytime from May through December) at different locations and that there was no seasonal trend in the exceedances that could define a critical period. Since the sampling at these sites is monthly and random without bias to climatological or hydrological events, it is assumed that this data covers the range of critical conditions.

Upper River TMDL Allocation and Results

The TMDL fecal coliform reduction goals were calculated using 1998 baseline data. The goals are presented as concentrations rather than fecal coliform count loads. To meet the TMDL, concentration-based load allocations were established for all monitoring stations in the Upper Willapa River. An allocation of fecal coliform loads does not address the criteria compliance requirements under various hydrologic conditions at the site. For example, a high fecal coliform count out of compliance under low flow conditions may have a lower load than a lower count within compliance under higher flow conditions (Ecology, 2004). The calculated fecal coliform targets along with the required reductions using the statistical rollback method along the main-stem (upstream to downstream) and tributaries are shown below in Tables 9 and 10 respectively. The reductions along the mainstem varied from zero to 67 percent, and zero to 70 percent along the tributaries (USEPA, 2004b).

Table 9. Recommended Fecal Coliform TMDL baseline targets and reductions along the mainstem of the Upper Willapa River

Location	Existing		Limiting Criteria	Required Reduction
	Geometric Mean	90th Percentile		
Willapa R below Patton Creek	15.90	87.28	-	0.00%
Willapa R at Swiss Picknik Rd	174.69	613.23	200	67.39%
Willapa R at Lebam	144.77	375.45	200	46.73%
Willapa R above Trap Creek	57.38	123.42	-	0.00%
Willapa R at Oxbow Road	74.12	445.48	200	55.11%
Willapa R at SR 6 near Menlo	97.54	460.28	200	56.55%
Willapa R Camp One Rd	74.96	257.34	200	22.28%

Values are concentration of bacteria colonies per 100 millileters

Table 10. Recommended Fecal Coliform TMDL baseline targets and reductions for the Upper Willapa River tributaries

Location	Existing		Limiting Criteria	Required Reduction
	Geometric Mean	90th Percentile		
Falls Ck above Retreat Center	51.37	259.85	200	23.03%
Fern Creek at Elk Prairie Rd	193.31	669.37	200	70.12%
Fork Ck at A-400 Bridge	29.49	240.00	200	0.00%[a]
Trap Creek at B-Line Bridge	19.86	107.86	-	0.00%
Stringer Creek at Highland-Stringer Rd	17.50	62.78	-	0.00%
Mill Ck at 3rd Mill Ck Rd Br	50.50	162.26	-	0.00%
Wilson Creek near mouth	88.	240	200	20%

a: No reduction was applied since only one sample exceeds the 90th percentile (<10% of all samples) criterion which is the controlling criterion.

Values are concentration of bacteria colonies per 100 millileters

Figure 2 shows where the locations of the listed segments are and the corresponding stations where reductions were calculated. The 303(d) listed segments for fecal coliform along the Upper Willapa River were based on Ecology's Proposed 2002 Water Quality Assessment GIS shapefiles (proposed listing as of January 15, 2004). <http://apps.ecy.wa.gov/wqawa/viewer.htm>).

Seasonal Variation for Upper and Lower River Analyses

Baseline sampling occurred monthly from April through December 1998. Seasonal variations were considered in the study design. Exceedances of water quality standards occurred at different times (anytime from May through December), at different locations and there was no seasonal trend in the exceedances that could define a critical period. Since the sampling at these sites was monthly and random without bias to climatological or hydrological events, the data covers the range of critical conditions.

The lower river TMDL was developed for two seasons: spring-summer (April-October) and late fall (October-December). The spring-summer period is characterized by low

stream flow in which the river is more susceptible to impacts from point sources of FC bacteria. The winter period has relatively higher stream flows and bacteria loads, both of which impact bacteria levels in the lower Willapa River. The TMDL allocations were developed using these seasonal divisions.

Margin of Safety for Lower and Upper River Analyses

A margin of safety (MOS) is required in all TMDLs to ensure that the TMDL is sufficiently protective of water quality when the uncertainty of the analysis is considered. The MOS for this TMDL implicit in conservative assumptions applied to the modeling. For instance, the model was run with all of the point sources simultaneously discharging at their peak flow rates and bacteria concentrations. Nonpoint source loading was set at the highest season concentrations for critical conditions. Peak river flows were also factored with the observed bacteria concentrations to emphasize highest levels of bacteria mass loading. The TMDL reduction goals are derived from the highest values for bacteria loading, river flows, etc. to accommodate water quality protection under the worst case conditions.

Evidence of Significant Water Quality Improvements Since 1998

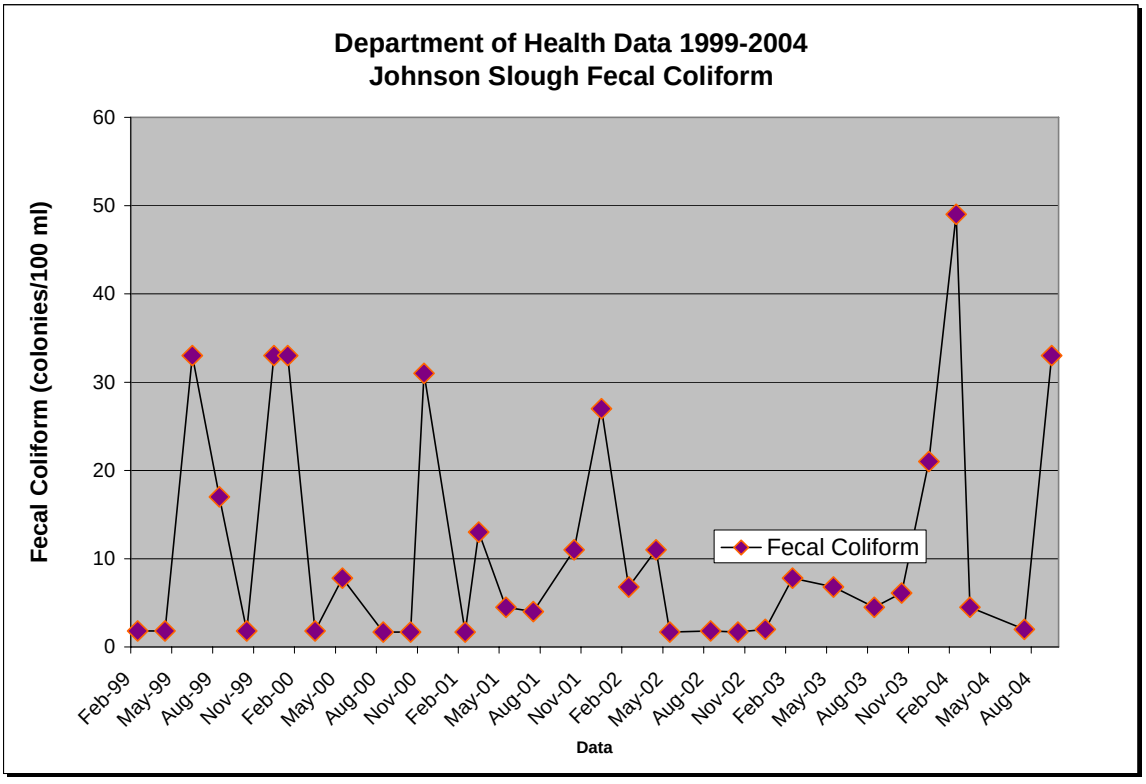
The previous report sections documented 1998 conditions and improvements needed at that time. Fortunately more current data from the state Departments of Health, and Ecology show that local restoration efforts have improved water quality compared to baseline 1998 levels. Locations sampled in the upper basin by Pacific County during 2004 show improvements as well. While conditions have generally improved in the lower river, about one sample each year still violates the marine standard at Johnson Slough.

Summary of Recent Studies:

Pacific County data-- The County Health Department sampled during 2003-04 at three locations upstream of Camp One Rd. Compared to 1998, averaged values of bacteria levels dropped by 13% just below Patton Creek, dropped by 53% at Lebam, and were about 45% lower at Camp One Rd. The Camp One Rd. and Lebam stations still failed standards. Highest concentrations typically occurred just after rainfall, but water quality violations also occurred on some days during summer baseflow conditions. The reductions were calculated by comparing baseline data from Pickett, 2000, with information from Herrera, 2005 (Appendix C).

State Dept. of Health and Ecology information 1999-2004-- The DOH Shellfish Protection Program samples every-other-month at several spots near the river mouth. While the DOH data have less statistical meaning than more frequent sampling (like monthly sampling by Ecology and Pacific County), they are certainly credible and show that the river mouth conditions met standards fairly routinely (Appendix D). A data summary is shown in Figure 3 (Zentner, 2006). The diamond-shapes in Figure 3 represent individual sample bacteria values; when all the data are evaluated collectively or even averaged by season (i.e. winter), they meet state standards. Figure 3 is primarily intended to show that bacteria concentrations are highest during the wintertime sample events.

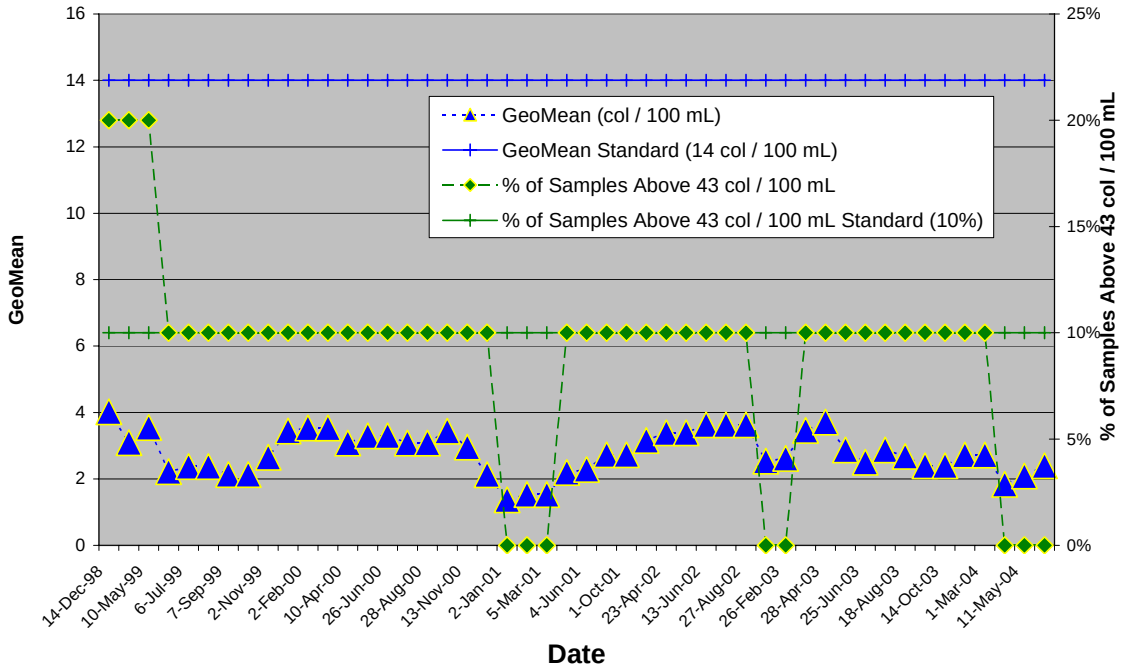
Figure 3. Department of Health Johnson Slough FC Data 1999-2004



DOH personnel point out that they were able to expand the shellfish harvest area farther upstream in 1997 when Ecklund Park was hooked up to the city treatment plant. It's important to note that the TT report and TMDL project goals strongly considered a need to make sure pollution remains in check so that the safe-growing area 'sanitary line' doesn't have to be moved "backwards" farther into the Bay.

Ecology's Ambient Marine Water Quality monthly sampling program data also show the river mouth (lower river TMDL critical area) are generally meeting bacteria standards, except for about one sample event each year (Appendix E). An overview of the ambient sampling program data analysis is presented in Figure 4 (Zentner, 2006). The triangle-shaped sample-values running horizontally close to the bottom of the figure correlate to the geometric-mean criteria of 14 cfu. All of the samples as well as the geometric-mean calculation of the samples collectively, meet the geometric mean criteria of 14 cfu along the left side of the figure.
The smaller diamond-shapes correlate to the other water quality criteria that limits the percentage of sample-values to "no more than 10% can exceed 43 cfu". You can see that almost all the sample values are along the horizontal line matching the "10% of samples above 43 colonies/100ml." along the right side of the figure. These data illustrate that water quality just (or barely) met standards at Johnson Slough with no meaningful margin for safety.

Figure 4. Willapa River at Johnson Slough
Fecal Coliform Statistics, Ecology Marine Flight Data 1997-2004



Conclusions from a synthesis of the baseline TMDL and current data:

The Tetra Tech TMDL reports form a credible basis for setting cleanup goals based on 1998 water quality conditions. Compared to the ultimate goal of meeting water quality standards, latest sampling results suggest that the TMDL has been achieved in the lower river but that much more work is needed upstream of Camp One Rd. Ongoing work by the Pacific CD, County Health Dept. and others will probably identify likely sources that can be better managed and controlled. The Pacific CD expects to continue promoting and delivering farm planning services to landowners. Possible sources of failing on-site-septic systems will continue to be identified by the County Health Dept. Ecology plans to continue helping identify grant and loan opportunities and provide technical assistance when desired by the local agencies and landowners. Ecology is currently conducting water quality verification sampling throughout the basin, to help local groups more easily find and fix pollution sources and to document how quickly cleanup is happening.
The cleanup strategies underway and planned are described in the Improvement Strategy section of this report.

The Improvement Strategy

The older and more current information are synthesized in this report to acknowledge bacteria reductions that have already been achieved, and work still needed to assure that water quality standards will be met throughout the Willapa system.

The Tetra Tech (TT) recommendations for bacteria cleanup are based on 1998 data but more recent data suggest bacteria levels have dropped in many parts of the basin. The TT studies estimate how much the pollution must be reduced from 1998 levels in order to achieve clean water (i.e., meet state water quality standards for bacteria). The TT studies are appropriate for setting baseline levels of bacteria cleanup, so that cleanup progress can be measured. The TT reports provide a reasonably accurate basis for the bacteria TMDL, or Total Maximum Daily Load that the river can receive and still meet standards.

Fortunately, more current data from the state Departments of Health, Ecology, and Pacific County show improvements in water quality compared to baseline 1998 levels. More sampling data are needed to track trends over the long-term, and ongoing monitoring is underway. But there's enough data now to suggest that TMDL implementation has been succeeding for some time. Conditions have generally improved in the lower river but the marine water quality standard at Johnson Slough is violated on about one sample event each year.
In the upper Willapa River, Pacific County data show that bacteria levels are also generally lower compared to the 1998 baseline, but still violate standards.

Summary of studies:

TMDL Conditions

Upper River conditions-- The stretch from Camp One Rd. upstream to Patton Creek failed standards fairly routinely in the mainstem and tributaries. The headwater location at Patton Creek met standards in 1998. Water quality varied significantly depending on the location sampled. The Tetra Tech study recommends reductions of up to 67% for places along the mainstem, and reductions of up to 70% at the most impacted tributary locations sampled (Appendix A, USEPA, 2004a).

Lower River Conditions-- The 1998 field work showed that Lower River conditions significantly failed standards. Results determined that major reductions are called for in order for the lower river to meet the more protective marine water quality standards at the mouth of the river near Range Pt (Appendix B, USEPA, 2004b).
The TT report calls for reductions of tributary as well as mainstem pollution in order for the downstream points to meet standards. Overall reductions identified for the lower river ranges from 62% in the fall to 75% during the spring-summer. The study suggests that livestock may be a source of more than half the lower river bacteria pollution inputs.

Waterfowl were also accounted for and found to be fairly insignificant compared to other sources. Current discharge limits set for the treatment plants near the river mouth were found to be protective of water quality and no further bacteria controls are required of them.

Recent Conditions

Pacific County data-- Pacific County Health Dept. sampled during 2003-04 at three locations upstream of Camp One Rd. Compared to 1998, averaged bacteria levels dropped by 13% just below Patton Creek, dropped by 53% at Lebam, and were about 45% lower at Camp One Rd. The Camp One Rd. and Lebam stations still failed standards. Highest concentrations typically occurred just after rainfall, but water quality violations also occurred on some days during summer baseflow conditions.

State Dept. of Health and Ecology information 1998-2004-- The DOH Shellfish Protection Program samples every-other-month at several spots near the river mouth. While the DOH data have less statistical meaning than more frequent sampling (like the monthly sampling by Ecology and Pacific County), the data are certainly credible and show that the river mouth routinely met standards.

Ecology's Ambient Marine Water Quality monthly sampling program data also shows the river mouth to be generally meeting bacteria standards.

During 2004, Pacific County also conducted a "microbial source tracking" study to help describe the relative contributions of various fecal coliform sources in the upper river system (e.g., people, cows, dogs, cats, birds, various wildlife species, etc.) A detailed review of that information and ongoing work by the Pacific CD, County Health Dept. and others will probably identify likely sources that can be better managed and controlled. The Pacific CD plans to continue promoting and delivering farm planning services to landowners. Possible sources of failing on-site-septic systems will continue to be identified by the County Health Dept. Ecology plans to continue offering technical assistance and helping find funding for the local agencies and landowners. Ecology began a year-long fecal coliform bacteria verification sampling project in 2006; early results further document bacteria reductions and will also help local groups more easily find and fix pollution sources and to document how quickly cleanup is happening.

Tables 9, 11, and 12 in the earlier technical-analysis part of this report show how much bacteria needs to be reduced from 1998 conditions (Appendices A and B, USEPA, 2004a; USEPA, 2004b).

In addition, the technical analysis determined that bacteria loading from the Raymond and South Bend stormwater outfalls should be reduced by 90% from their 1998 baseline values. Considered to be nonpoint pollution because it represents drainage from multiple diffuse sources, controls may vary according to the nature of each stormwater source. This TMDL does not call for collection and treatment of stormwater at the city treatment

plants. Rather, more vigilant identification and control of bacteria pollution at its source is what will continue to control stormwater pollution.
Wasteload allocations for the existing discharges of all of the permitted facilities (two city treatment plants and three seafood processors) were set to their permitted rates. In other words as long as the facilities meet their permit limits of 200 cfu/100ml they will be doing their fair share for meeting the TMDL overall.

The main human-controlled sources of fecal coliform bacteria in this watershed are believed to be livestock waste, leaking or poorly maintained on-site septic systems, and probably pet waste. Restoring good water quality will depend on the actions of the people living in the watershed. For livestock sources, technical assistance is available and, in some cases cost share incentives are also available. For septic systems, assistance may be available to help identify problems and low interest loans may be available to help with repairs or upgrades. Generally, participating organizations will work with landowners to build awareness and create solutions practical to each situation. While voluntary compliance is the goal, enforcement options exist at the county and state level, if needed.

This plan establishes a goal of achieving bacteria reductions by 2012 (i.e., five years following completion of the *Water Quality Improvement Plan).* Ecology will submit this *Water Quality Improvement Report* to the Environmental Protection Agency (EPA) for approval. Following approval, local agencies and citizens will develop a detailed plan for clean up. That *Water Quality Implementation Plan* is anticipated to be complete by Fall 2007.

This strategy describes the framework for improving water quality in tributaries and the Willapa River. It describes the types of activities that will be conducted and the entities, authorities, and programs that will be used. Ultimately, the actions of individual landowners determine water quality. Implementation of this TMDL was actually started even before the TMDL field study was completed, and at least five years before TMDL load allocations were determined.

Water Quality Protection Underway

The Willapa River and its tributaries flow into marine water of Willapa Bay, where bacteria concentrations can affect shellfish harvest. In the tributaries and mainstem river, the amount of bacteria indicates a potential health risk to recreational users and potential impacts to shellfish harvest.

Local jurisdictions, the Conservation District and NRCS, landowners, and citizens groups have been working to protect and restore these areas for many years. For example, local natural resource planning groups produced a *Watershed Analysis* (Weyerhaeuser, 1994) and *Salmon Recovery Strategies* (Willapa Bay Water Resources Coordinating Council, 2006) that have led to installation of best management practices (BMPs), education and outreach, riparian restoration, and water quality monitoring.

Many land improvements have resulted which help prevent livestock manure and bacteria runoff to surface water. For example, a large tideland pasture located at Potter Slough in the lower river typically supported up to 300 cows, until 2005 (Personal communication, Pacific Conservation District Board, 2006). The land was sold for wetland conversion to restore it to natural river functions, the cattle were removed.

Other actions by the County Community Development and Health Departments have helped guide a variety of water quality improvement actions like availability of low-interest loans for septic system repair. Some actions like the 1997 conversion to sanitary sewers in the residential Ecklund Park neighborhood reduced bacteria levels to the lower Willapa River and allowed state DOH Shellfish Protection Program to justify expanding the commercial shellfish harvest area closer to the river mouth. These bacteria reduction activities, implemented largely by landowners and the City, resulted in the upgrade of about 150 acres of growing area in 1998.
The state Dairy Nutrient Management Program legislation was enacted and implemented in April 1998. All dairies in the Willapa watershed are now fully implementing farm management plans that have significantly reduced bacteria discharges to water. Major federal and state financial assistance programs have helped landowners improve their farm operations, economics and land conditions while helping to improve water quality. Direct benefits of the improved farm activities are described more fully below.

One grant was awarded to the Pacific CD in 2003 for farm management planning services and to help finance landowner projects that directly support this TMDL implementation. Livestock exclusion (fencing) and riparian planting has been applied to approximately 9300 feet of shoreline on three land parcels in important river segments of this TMDL. The CD expects to apply the grant to four additional segments (9000 feet of shoreline) before the grant expires in 2006.

The CD also implements the federal Conservation Reserve Enhancement Program (CREP). Two Willapa Valley landowners have participated in this program since 1998. Landowners install fencing and riparian plantings on their shorelines and place that area in an easement in exchange for a multi-year lease payment. Those 2 agreements protect more than 6,000 feet of shoreline and provide a buffer of approximately 10 acres of land. Alternative livestock watering equipment is included since the cattle can no longer directly access the river to drink.
These arrangements frequently allow or encourage more efficient and cost-effective grazing management opportunities. Producers have found that the different grazing rotations helps promote a more healthy plant cover, improves forage quantity and quality, and stabilizes the soils better than an uncontrolled animal access situation. The added practice of riparian planting further reduces soil loss from erosion and river washout. Simply put, Willapa landowners have found the practices help enhance and preserve their land base (personal communication, Mike Johnson, 2006).

Similar financial and conservation returns have been demonstrated with use of the federal Environmental Quality Incentive Program (EQIP) implemented in the Willapa basin by the Natural Resource Conservation Service. EQIP was a primary grant helping dairy farmers initially implement the Dairy Nutrient Management Act requirements. Grants paid for capital improvements like manure containment and dry-stacking that allows nutrients to be captured and utilized instead of wasted in runoff to surface water. Carefully timed and controlled rates of livestock nutrient applications has improved forage quality and quantity, improved land /soil health and reduced the need for

commercial fertilizer purchases. EQIP Program participants were initially very skeptical of the potential value of the activities brought by the DNMP, but many have effectively applied the program on their farms for financial and ecological profit.

While the water quality benefits of the increased investments in farm planning and improvements cannot be directly quantified, monitoring shows that water quality has certainly improved since 1998. More financial and technical support for the agriculture sector would be especially helpful.

What More Needs to be Done?

Continue actions that reduce fecal coliform bacteria

Cleanup activities will first target the most likely human-related sources of bacteria, and will focus on those areas shown by the technical analysis to be the biggest sources of bacteria:

Livestock Waste Management: Based on the microbial source tracking study (MST) by Pacific County in 2004, livestock waste is suspected to be the largest contributor of manageable bacteria to the Willapa River system. Management practices to reduce the amount of bacteria going into streams typically include:

- restricting livestock access to creeks
- containment and judicious usage of livestock manure products
- riparian restoration
- good pasture management
- controlling roof runoff

An important step will be to evaluate the conservation improvements made since 1998 when the Willapa surface waters were first identified as violating bacteria standards. Are they still in place? Are they still effective? Have land uses changed? Technical assistance and, when possible, cost-share incentives will be the primary approach to reducing bacteria from livestock. Education and outreach will also be important, to increase awareness of issues and involve more landowners in developing solutions. Where known sources exist and voluntary approaches are insufficient, enforcement is possible by both county and state jurisdictions.

Failing septic systems can leak bacteria and other pathogens into nearby waterbodies. Activities to reduce this source include:

- Conduct surveys of septic system maintenance records and on-site visits or windshield tours to followup on 2004 MST testing to identify likely locations of septic system problems-- i.e., the area that was sampled near Lebam.

- Conduct more focused septic system surveys and investigation to identify sources (may include dye testing, sampling seeps or stream segments, or other methods)

- Apply or develop local regulations to initiate corrections, possible action by state or County Health agencies to designate "area of special concern"

- Provide septic system operation and maintenance education and outreach.

As funding opportunities allow, support may be available to help landowners take care of problems. This might include, for instance, incentives like rebates to homeowners for having their systems inspected or pumped. A low interest loan program operated by Pacific County might be expanded to serve homeowners in new priority areas or a similar program be made available to accommodate repairs. Pacific County was instrumental in helping establish a low-interest loan program for homeowners to repair or replace failing septic systems in areas having potential to impact shellfish.

Stormwater runoff and inflow/infiltration has been a big challenge for the cities of Raymond and South Bend. Several stormwater outfalls have been sampled and shown to have significant bacteria concentrations (Pickett, 2000). Local governments could evaluate future sample data so that pollution sources can be located. Once found, preemptive strategies can be discussed and implemented. The cities have been implementing changes to the stormwater conveyance infrastructure which is expected to help lower pollutant discharges. The city of South Bend in particular plans to motivate more homeowners with failing sewer pipe (side sewer lines) to repair their lines. The public works departments of Raymond and South Bend are committed to help get stormwater pollution in control (personal communication, Dean Parsons , Steve Russell, 2006).

Beyond the voluntary approach, federal and state stormwater regulations can apply if necessary. The federal Phase II program provides for a review of stormwater programs, to determine their consistency with the federal Phase II stormwater requirements. This review is even more likely to be required where stormwater controls are conditioned by a TMDL. The cities seem to understand that if they seriously commit now to stormwater controls required by the TMDL, and if a future Phase II program evaluation is required, they will hopefully be able to demonstrate their program consistency and avoid the full spectrum of the full permit requirements of Phase II.

The cities could also apply for funding and conduct source identification monitoring so that they can make informed decisions about proper stormwater controls.

Pet waste can contribute significant amounts of bacteria when left along a creek shoreline, or near enough to a drainage ditch, storm drain or watercourse to be washed in by runoff from rainfall. Runoff of pet waste is particularly suspect in the more highly populated neighborhoods of the cities. Some stormwater discharge sites in the cities have shown very high concentrations of fecal coliform bacteria. Outreach efforts to citizens should highlight the importance of managing this bacteria source. In some areas there may be a need and opportunity for structural solutions such as signs and pet waste stations. Large quantities of unmanaged waste, or intentional dumping could result in enforcement.

Following Environmental Protection Agency approval of this *Water Quality Improvement Report,* participating stakeholders will develop a detailed plan for

improving water quality. We will identify and prioritize specific responsibilities, actions, and BMPs, and describe a general timeline and potential funding sources.
Improving water quality will be an iterative process of evaluating and prioritizing potential sources, taking appropriate action, evaluating results and determining next steps. We may identify the need for additional actions during the detailed planning process, or as ongoing monitoring evaluates the effectiveness of actions taken. The entities described in the *Who Will Participate* section below, and possibly others, will work together to coordinate the process.

The earlier technical analysis in this report presents data from Ecology and local jurisdictions. It provides an analysis of bacteria concentrations, guidance on how much reduction is needed in order to meet water quality standards, and a relative look at how much bacteria the tributaries contribute to the marine environment (loading during 1998). These analyses, combined with local knowledge of land use, will be used to target resources and activities.

The river was monitored at several locations. Baseline and later sampling however, monitored most tributaries only at their mouth. Therefore, the technical analysis for those creeks provides evaluation of water quality and pollution loads only at the creek mouths. Many questions remain unanswered about specific sources and source areas. In some cases, conclusions from the analysis cannot be easily explained by observed land use patterns. Other questions will arise during the course of the cleanup. Monitoring, investigation, and evaluation will be an ongoing need. This might include water quality sampling, land use surveys, creek walks, dye testing, or upstream/downstream sampling for on-site septic system effects or other methods chosen by local groups. Monitoring will likely be accomplished through a combined effort involving the county, state, and could include volunteers and student groups.

Who Will Participate?

The people who live in and use the Willapa River watershed will ultimately be responsible for improving water quality. The following agencies and groups will be working, in the various roles described below, to help landowners recognize and make needed changes.

Cities of Raymond and South Bend

The Cities will continue steps to identify and isolate inflow and infiltration, or other cross-connections that could add pollutants (especially fecal coliform bacteria) to the stormwater system. Raymond will continue operating a vactor waste program to remove pollutants from stormwater catchments before the stormwater is discharged to the river system. Both Cities plan to continue analyzing stormwater sampling data to understand, locate and correct sources of Bacteria stormwater pollution.

This TMDL does not create new requirements for the cities to collect and treat stormwater in their treatment plants. Stormwater pollution sources will continue to be addressed according to local wastewater management plans, other local initiatives, and appropriate sections of the Stormwater Management Manual for Western Washington (Ecology, 2001).

The federal NPDES municipal stormwater permitting program is unlikely to affect the Cities, especially if they stay committed to stormwater pollution protection programs that they conduct voluntarily. Beyond the voluntary approach, federal and state stormwater regulations might apply if necessary. The federal Phase II municipal stormwater program allows third-parties to request a regulatory review of stormwater programs, to determine their consistency with the federal Phase II stormwater requirements. This review is even more possible to be required where the stormwater pollution is a direct component of a TMDL.

Pacific Conservation District (PCD)

Pacific Conservation District, under the authority of Ch. 89.08 RCW, develops farm plans to protect water quality by providing education and technical assistance to residents. Their work is non-regulatory.
They work with landowners to develop BMPs that realize maximum productivity while protecting the quality of both surface and underground water resources. The Conservation District is able to provide financial support for BMPs to some landowners through cost share programs which are funded by state and federal agencies. When developing farm plans, the district uses guidance and specifications from the U.S. Natural Resource Conservation Service.

The District also receives grants from the Conservation Commission, Ecology, the Salmon Recovery Funding Board, and others. Landowners may receive a Notice of Correction from Ecology if management practices on their land could potentially pollute waterbodies (for instance, livestock or runoff of their waste in the creek or insufficient vegetation along a streambank to intercept animal waste). Typically, the notice will refer the landowner to Pacific Conservation District for assistance.

The Pacific CD is conducting a farm inventory during spring of 2006 that will help update their knowledge of types and amounts of farming activities. The project will enable a more strategic approach to prioritization and strategic planning of CD services. On-farm surveys being conducted during the inventory are also helping to recruit willing landowners for ongoing voluntary implementation of conservation practices. **At their February 2006 Supervisory Board meeting, the chairperson provided a clear commitment to Ecology and others that the CD will continue to work very hard to implement water quality protection programs, and convince their neighbors to do-the-right-things. They value clean water and have a good relationship with their neighbors which enables them to effectively influence increased implementation of water quality protection practices.**

Pacific County

The County Department of Community Development regulates land use and development in compliance in compliance with Washington State's Growth Management Act, Ch. 36.70A. The fish and wildlife habitat conservation chapter of the resource ordinance addresses buffers widths for streams, lakes and saltwater shorelines. These regulations apply to development activities in Pacific County.
The County Health Department administers local ordinances for on-site septic system management. The Pacific County Board of Health Ordinances 3A and 3B describe elements of the County's program that help prevent and correct on-site septic pollution problems.
Statewide, the county health departments have the specific requirement to:
"Identify failing septic tank drainfield systems in the normal manner and will use reasonable effort to determine new failures." (RCW 70.118.030)
“The normal manner” implies the use of inspections and responses to citizen complaints. Inspections are to take place in areas where water quality standards have been violated. Ongoing water quality sampling/monitoring by the conservation districts, Ecology, and

others will supplement information gathered by the health departments in order to better characterize probable locations of failing septic systems. This will help prioritize sub-basins or other locations for follow-up by the health departments. State regulations (246-272 WAC) also direct local health departments to assure that system operators:
• Are aware of the need for ongoing operation and maintenance;
• Know how to provide the needed operation and maintenance; and
• Have access to professional services.

- Health departments must also must have a process to review their on-site septic program for effectiveness

Pacific County health department has an administrative plan to respond to on-site sewage system failures, including, where appropriate, inspection of these systems. They could also pursue development of new financial assistance programs for homeowners, and work to expand the areas eligible for the State Shellfish Reserve Septic Loan Account Program already established in the County. They may specifically request Centennial Grant and State Revolving Fund loans to support local projects. The following implementation strategy outlines steps that the health department can take to control on-site septic sources.

A. Identify Sources
• Phased Approach
• Develop Complete and Accurate List of Septic Systems in Basin
• Oversee a Septic Maintenance Inspection Program (Statewide Requirement for Homeowners)
• Use Monitoring Results to Focus Efforts

B. Identify Control Measures
• Provide List of Certified/Licensed Inspection Contractors.
• Provide List of Certified Pumpers and Repair Contractors.
• Provide Educational Materials.
• Require Repairs or Replacements if Necessary.

C. Develop/Conduct Community Education, and Broker Financial Assistance Programs
• Prioritize local "pre-emptive" audiences: public officials, banks/lenders, dealers of pre-manufactured homes, and real-estate industry.
• Prioritize system owners/neighborhoods according to monitoring program results.
• Hold educational meetings for communities in various priority subbasins of the Watershed.
• Coordinate grant assistance to OSS operators, advise and advocate for local utility districts in order to develop financial support for effective local OSS protection programs

Natural Resources Conservation Service (NRCS)

The NRCS works in partnership with Conservation Districts to improve water quality and conservation. Resources are targeted to address water quality priorities identified through

watershed planning, WA Department of Health surveys, TMDLs, and other planning processes. The NRCS administers all of the programs in the 2002 Farm Bill, including:

- Conservation of Private Grazing Land Initiative
- Conservation Security Program
- Conservation Technical Assistance
- Environmental Quality Incentives Program
- Emergency Watershed Protection Program
- Farm and Ranch Lands Protection Program
- Grassland Reserve Program
- Plant Material Program
- Resource Conservation and Development Program
- Snow Survey and Water Supply Forecasts Program
- Soil Survey Programs
- Technical Service Providers
- Wetlands Reserve Program
- Wildlife Habitat Incentives Program

These programs are available to landowners in Pacific County. Several of the programs provide cost-share incentives to landowners who commit to implementing certain conservation practices. For more information on Farm Bill programs, go to www.wa.nrcs.usda.gov/programs/index.html
In addition to these programmatic resources, the NRCS provides staff time and technical expertise to support restoration efforts.

Puget Sound Water Quality Action Team, with Pacific County and Shorebank Enterprise Pacific Bank

The Puget Sound Water Quality Action Team (PSAT), under authority of Washington State Chapter 273 Laws of 2001, works with governments and organizations in Pacific County to carry out the state Shellfish Reserve Account Septic Loan Program. Revenues from the sale of oysters and leases from state-owned tideland in Grays Harbor and Pacific Counties are available to help finance the repair of on-site sewage systems that could be contaminating shellfish growing areas. The account is administered by the Washington Department of Fish and Wildlife, which passes the septic system repair funding through to the Puget Sound Action Team for administration. Memorandums of Agreement between 1) the PSAT and Pacific County, and 2) Pacific County and Shorebank Pacific Bank describe how the program operates locally. The Loan Program was piloted in Pacific County during 2003 and revenues are expected to be available for the county to operate the program next biennium as well.

Washington Department of Agriculture

Under RCW 90.64, Washington Department of Agriculture Livestock Nutrient Management Program is responsible for regulating nutrient management activities related to all dairy and combined animal feeding operations (CAFOs) in Washington State. The goal of the Livestock Nutrient Management Program is to work with producers and stakeholders to protect water quality, promptly respond to complaints and concerns related to dairy and CAFO livestock operations, and promote a healthy dairy and livestock industry. The development and enforcement of permits associated with livestock activities will be coordinated with TMDL implementation. Facilities under permit will be inspected on a routine basis to determine compliance with the permit including no discharges to surface or groundwater.

When the Department of Agriculture Livestock Nutrient Management Program confirms that poor farm management practices on dairies and CAFO livestock operations are likely to be adversely affecting surface waters, landowners are referred to local conservation districts for technical assistance. If necessary, the Nutrient Management Program can require specific actions under the Water Pollution Control Act (Ch. 90.48 RCW), such as implementation of an approved Nutrient Management Plan, updates to existing Nutrient Management Plans, Notices of Violation, Administrative Orders and Penalties to correct problems that impact water quality.

Washington Department of Health (DOH)

The Washington Department of Health (DOH), under authority of Ch. 43.70 RCW, regulates commercial shellfish harvest. As part of this program, they monitor marine water quality in commercial shellfish growing areas of the state including the Willapa and Bruceport areas. DOH is responsible for ensuring that the standards of the National Shellfish Sanitation Program are met in all commercial and public recreational shellfish growing areas in Washington State. They also advise and work jointly with the Pacific County Health Department on shellfish closures, pollution concerns, and shoreline conditions that could affect water quality in shellfish production areas of Willapa Bay. DOH also administer minimum on-site sewage system requirements in Chapter 246-272A WAC. DOH has recently revised this regulation. Different parts of the regulations are scheduled to take effect at different times. The majority of the revised sections will be in effect by July 1, 2007.

Washington Department of Ecology (Ecology)

Washington Department of Ecology has been delegated responsibility under the federal Clean Water Act by the U.S. Environmental Protection Agency to establish water quality standards, coordinate water quality improvement projects (TMDLs) on waterbodies that fail to meet water quality standards, and enforce water quality regulations under the Water Pollution Control Act, Chapter 90.48 RCW. In addition to this regulatory role, Ecology provides financial assistance to local governments, tribes, conservation districts, and citizens groups for water quality projects. Projects that implement water cleanup plans for TMDLs are a high priority for funding.

For agricultural problems other than dairies or confined animal feeding operations, farmers may be referred to conservation districts for technical assistance if Ecology confirms that poor farm management practices are likely to be polluting surface waters. If necessary, Ecology can
require specific actions under Ch. 90.48 RCW, such as implementation of an approved farm plan, to correct the problem.
Ecology is currently developing stormwater municipal NPDES Phase I and II permits. These permits cover nonpoint pollution in urbanizing areas generally with populations above 10,000. They are expected to be final in 2006. It's unlikely that the municipal NPDES stormwater program would apply to the Cities of Raymond or South Bend. However, the program laws allow a third-party to petition Ecology to review a local stormwater program for consistency with the program objectives. Stormwater discharges to a TMDL-affected waterbody could become the focus of such a review.

Environmental Protection Agency (EPA)

EPA is ultimately responsible for seeing that the federal Clean Water Act is implemented, and water quality is restored. EPA contracted with a technical services firm, Tetra Tech, Inc. to produce the technical basis for this TMDL . They also provide funding to help implement many kinds of water quality protection actions.

Reasonable Assurance of TMDL Success

EPA's approval of the TMDL requires a demonstration that the combination of wasteload (for the permitted facilities) and load allocations (for nonpoint sources including stormwater) in the TMDL can reasonably succeed in bringing the waterbody into compliance with standards. The technical analysis determined that the wasteloads needed are equivalent to the facilities current discharge permit limits and no further reductions are required of them in this TMDL.
Also, the sensitivity analysis showed that the point source discharges have little impact on the bacteria level in the lower river, so lowering their bacteria discharges below the permit limits will not contribute towards bringing the water into compliance. Consequently reasonable assurance of success depends on ongoing performance of nonpoint source pollution controls.
The demonstrated pace of lowering bacteria concentrations in the Willapa river system in the past seven years suggests that the water quality standard could be consistently achieved by 2012. Local groups are on track to find and fix failing septic systems, livestock waste problems, and reduce bacteria pollution to stormwater. Their recent success is documented in the section **Evidence of Significant Water Quality Improvements.**

Adaptive Management

Continued water quality improvements will involve an iterative process of evaluating information, taking action, evaluating results of those actions and deciding what comes next. The involved organizations will work together to manage the cleanup. Water quality improvement actions have been evolving in the Willapa River system with considerable progress, for many years. The percent-reduction goals carried forward from the 1998 data reductions are just that...goals. The final standard for achievement of the TMDL is for the river to be in compliance with water quality standards.

Potential Funding Sources

Potential funding sources:

- *Centennial/State Revolving Fund (SRF)/319* – These three funding sources are managed by Ecology through one combined application program. Funds are available to public entities as grants or low-interest loans. Grants require a 25 percent match. They may be used to provide education/outreach, technical assistance for specific water quality projects, or as seed money to establish various kinds of water quality related programs or program components. Grant funds may not be used for capital improvements to private property. However, riparian fencing, riparian re-vegetation, and alternative stock watering are grant-eligible, if a landowner easement is given. Low-interest loans are available to public entities for all of the above uses, and have also been used as "pass-through" to provide low-interest loans to homeowners for septic system repair or agricultural best management practices. Loan money can be used for a wider range of improvements on private property.

- *Conservation Reserve Enhancement Program* (CREP) – This program provides incentives to restore and improve salmon and steelhead habitat on private land. This is a voluntary program to establish forested buffers along streams where streamside habitat is a significant limiting factor for salmonids. In addition to providing habitat, the buffers improve water quality and increase stream stability. Land enrolled in CREP is removed from production and grazing, under 10-15 year contracts. In return, landowners receive annual rental, incentive, maintenance and cost share payments. The annual payments can equal twice the weighted average soil rental rate (incentive is 110 percent in areas designated by Growth Management Act). CREP is administered by the Natural Resources Conservation Service.

• *Conservation Reserve Program (CRP)* – A voluntary program that offers annual rental payments, incentive payments for certain activities, and cost-share assistance to establish approved cover on eligible cropland. Assistance is available in an amount equal to not more than 50 percent of the participant's costs in establishing approved practices; contract duration between 10-15 years. The program is administered through the conservation district.
• *Environmental Protection Agency* – The EPA provides funding to apply toward water quality improvement. There are also specific grants such as the Watershed Initiative Grant which can provide substantial funding.
• *Environmental Quality Incentives Program (EQIP)* - This federally funded program is also managed by Natural Resources Conservation Service:

- Provides technical assistance, cost share payments and incentive payments to assist crop and livestock producers with environmental and conservation improvements on the farm.
- $5.8 billon over next 6 years (nationally).
- 75% cost sharing but allows 90% if producer is a limited resource or beginning farmer or rancher.
- Program funding divided 60% for livestock-related practices, 40% for crop land.
- Contracts are 1 to 10 years.
- No annual payment limitation, but sum not to exceed $450,000 per individual/entity.

• *Wetland Reserve Program (WRP)* – A voluntary program to restore and protect wetlands on private property (including farmland that has become a wetland as a result of flooding). Landowners can receive financial incentives to enhance wetlands in exchange for retiring marginal agricultural land. Landowner limits future use of the land, but retains ownership, controls access, and may lease the land for undeveloped recreational activities and possibly other compatible uses. This is a USDA program administered by the Natural Resources Conservation Service.

- *Salmon Recovery Funding Board (SRFB)* - This Board was set by the Washington State Legislature in 1999. They provide grants for fish habitat protection and restoration, and related projects that produce sustainable and measurable benefits for fish and their habitat. Many habitat restoration projects in Pacific County have been funded by the SRFB lead entity. Streamside riparian planting is a common project element; an effective riparian cover often helps discourage livestock access to the stream and helps block runoff of manure.The local lead entity expects to continue using SRFB grants for these projects.

• *United States Department of Agriculture (USDA)* - Rural Housing Repair and Rehabilitation Loans are loans funded directly by the federal government. These loans are available to very low-income rural residents who own and occupy a dwelling in need

of repairs. Funds are available for repairs to improve or modernize a home, or to remove health and safety hazards. This loan is a 1 percent loan that may be repaid over a 20 year period.

- *State Shellfish Reserve Land Account Loan Program*

Revenues from the sale of oysters and leases from state-owned tideland in Grays Harbor and Pacific Counties are available to help finance the repair of on-site sewage systems that are contaminating shellfish growing areas. The account is administered by the Washington Department of Fish and Wildlife, which passes the septic system repair funding through to the Puget Sound Action Team for administration. The Loan Program was piloted in Pacific County during 2003 and revenues are expected to be available again next biennium in both Grays Harbor and Pacific counties.

- *State Community Development Block Grants (CDBG*)- City of South Bend residents have access to a CDBG Grant for replacing failing side sewers. The City has helped many homeowners apply for and utilize the funds; many more homes are known candidates for use of these grant funds.

- *Washington Wildlife and Recreation Program (WWRP)*- In 2005 the Washington State Legislature created grants to conserve vanishing farmland and to protect the state's rivers, lakes, streams, and saltwater areas. The law adds two new categories—Riparian Protection and Farmland Conservation—to the highly acclaimed WWRP.

Under the new **Riparian Protection** category local governments and lead entities for salmon recovery may apply for WWRP grants to protect and/or restore shorelines, rivers, streams, estuaries and other waterways. For more information see: http://www.iac.wa.gov/iac/grants/riparian_habitat.htm.

WWRP **Farmland Conservation** grants are available to help cities and counties conserve working farms. In most Washington counties these grants will be the only funding source for farm conservation easements (other than a small share of the federal Farm and Ranchlands Protection Program). For more information see: http://www.iac.wa.gov/iac/grants/farmland.htm.

Local governments are also eligible to apply for WWRP grants for the acquisition or development of local parks, trails, water access areas and urban wildlife habitat. The WWRP is administered by the Washington State Interagency Committee for Outdoor Recreation (IAC)

Next Steps

Ecology will submit this Water Quality Improvement Report to the Environmental Protection Agency for approval. Following approval, local agencies and citizens will develop a detailed plan for improving water quality. That Water Quality Implementation Plan is anticipated to be complete by fall 2007.

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Appendices

Appendix A - Analytical Framework and Technical Analysis for the Upper Willapa River Fecal Coliform Bacteria TMDL, June, 2004. Prepared by Tetra Tech for U.S.Environmental Protection Agency, Region 10

Appendix B - Lower Willapa River Fecal Coliform Bacteria TMDL Evaluation, August , 2004. Prepared by Tetra Tech for U.S. Environmental Protection Agency, Region 10

Appendix C - Monitoring Report: Upper Willapa River Microbial Source Tracking Study, June 2005. Prepared by Herrera Environmental Consultants for Cosmopolitan Engineering Group and Pacific County

Appendix D - Recent Fecal Coliform Data used in this Report (State Department of Health Shellfish Protection).

Appendix A

Lower Willapa River Fecal Coliform Bacteria

Total Maximum Daily Load Evaluation

Prepared by Tetra tech, Inc. for the
U.S. Environmental Protection Agency, Region 10
August 2004

(Contact the Department of Ecology to Request a copy of this report)

Appendix B

Analytical Framework and Technical Analysis for the Upper Willapa River Fecal Coliform Bacteria TMDL

Prepared by Tetra Tech, Inc. for the
U.S. Environmental Protection Agency, Region 10
June, 2004

(Contact the Department of Ecology to Request a copy of this report)

Appendix C

Upper Willapa River Microbial Source Tracking Study

Pacific County Department of Community Development
June 2005

(Contact the Department of Ecology or Pacific County for a copy of this report)

Appendix D

Washington State Department of Health Shellfish Protection Program Monitoring Data, Johnson Slough 1999-2004 (DOH Station #96)

Date	Time	Tide Phase	Temperature	Salinity	Fecal coliform Colonies/100 ml.
2/16/1999	10:17	FLOOD	8	5	6.80
4/12/1999	10:12	FLOOD	10	16	2.00
6/8/1999	9:20	EBB	14	16	23.00
8/10/1999	10:39	FLOOD	17	22	33.00
12/7/1999	9:58	FLOOD	7	0	79.00
1/18/2000	10:38	FLOOD	5	0	46.00
3/6/2000	10:00	FLOOD	8	4	1.80
5/15/2000	10:03	FLOOD	15	10	4.5
8/28/2000	10:51	FLOOD	19	20	11
10/9/2000	10:30	FLOOD	14	24	2.0
11/14/2000	10:21	FLOOD	8	16	130
2/6/2001	9:30	FLOOD	5	6	7.8
3/19/2001	12:45	EBB	10	15	23
5/21/2001	10:41	FLOOD	13	10	23
7/30/2001	9:56	FLOOD	17	22	23
10/16/2001	10:23	FLOOD	13	22	4.5
12/3/2001	11:52	FLOOD	9	0	49
2/25/2002	8:55	FLOOD	6	0	11
4/8/2002	9:36	FLOOD	10	10	27
5/6/2002	9:50	FLOOD	10	10	1.7
8/19/2002	9:53	FLOOD	17	25	13
10/15/2002	9:45	FLOOD	12	28	2.0
12/2/2002	9:44	FLOOD	8	21	6.8
2/10/2003	9:56	EBB	7	6	6.8
5/12/2003	8:58	FLOOD	13	12	2.0
10/6/2003	9:28	FLOOD	15	26	11
12/2/2003	9:31	EBB	8	0	110
2/3/2004	9:36	FLOOD	6	2	49
3/2/2004	9:34	FLOOD	6	10	4.5
7/12/2004	12:31	EBB	17	25	2
7/12/2004	12:38	EBB	17	24	17
9/13/2004	10:04	FLOOD	17	22	170
12/20/04	9:49	EBB	7	8	4.5
2/23/05	11:09	FLOOD	8	20	1.7

APPENDIX E

Washington State Department of Ecology Marine Flight Data
Johnson Slough 1997-2004

Station WPA 003
Johnson Slough

Date	Fecal Coliform Colonies/100 ml.	Flow (cfs)
12/22/1997	14	1164
1/30/1998		1996
2/26/1998	1	1167
3/24/1998	110	1038
4/15/1998	1	351
7/7/1998	2	59.1
8/17/1998	3	26.6
9/8/1998	1	22.6
10/5/1998	1	108
11/9/1998	2	1771
12/14/1998	60	2749
4/5/1999	1	462
5/10/1999	4	314
6/1/1999	1	146
7/6/1999	2	82.1
8/2/1999	2	52.2
9/7/1999	1	33.4
10/11/1999	1	109
11/2/1999	9	1769
1/5/2000	27	1333
2/2/2000	79	780
3/7/2000	1	728
4/10/2000	1	353
5/22/2000	2	372
6/26/2000	2	431
7/26/2000	1	92.6
8/28/2000	1	41
9/25/2000	3	38.2
11/13/2000	2	184
12/5/2000	1	564
1/2/2001	1	462
2/6/2001	3	604

3/5/2001	1	412
5/2/2001	71	471
6/4/2001	3	176
8/6/2001	6	161
10/1/2001	1	147
1/15/2002	13	2071
4/23/2002	4	817
5/16/2002	1	207
6/13/2002	2	119
7/9/2002	3	74.2
8/27/2002	1	33.9
10/30/2002	2	32

Date	FC (. per 100mL)
2/26/2003	4
3/24/2003	100
4/28/2003	2
5/20/2003	1
6/25/2003	1
7/22/2003	4
8/18/2003	1
9/16/2003	1
11/4/2003	7
3/1/2004	4
4/1/2004	2
5/11/2004	7
6/3/2004	4

APPENDIX F

Summary of Public Involvement

(Reserved for Conclusion of Public Comment Period and Responsiveness Summary)